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SLUDGE INCINERATION PLANT UNDER THE SOUTH-WEST WASTEWATER TREATMENT PLANT COMPLETION PROJECT

at the address: SWTP, 123, Volkhonskoye shosse, St. Petersburg

DESIGN

NON-TECHNICAL SUMMARY

St. Petersburg

2005

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1. ADVANCED METHODS OF SEWAGE SLUDGE DISPOSAL

Three basic methods of sludge treatment are used to dispose the sewage sludge, such as thermal drying, incineration and bio-thermal treatment (composting).

All three methods require prior dewatering of sewage sludge with the humidity of 96-99%. The sludge dewatering technology can ensure any required humidity of sludge in the range 60-80%.

The thermal drying of sludge is carried out by using furnace gases at the temperature of 500-800°C. These gases are generated by the burning of external fuels (natural gas, oil, etc.). Sludge is dried in various devices with either fixed or moving layer of the sludge to be dried. The drying process involves complete biological disinfection and deodorization of sludge.

The resulting dry sludge is stable during storage, contains organic substances, nutrients and mineral components, and is contaminated with heavy metals. The sludge can be used as a fertilizer, nutritional medium for cultivation of ferment or worms. The deficiencies of this method are: big consumption of energy resources which get more and more expensive and *high content of heavy metals in the dried sludge. For these reasons the demand is limited, and sludge accumulates at the point of production.*

Sludge incineration is a time-proved, environment-friendly, highly-reliable solution. Sludge oxidation with atmospheric air in the combustion process can reduce its mass 3-4 times and its volume tenfold. The burning kills all harmful organisms, and many chemical toxicants are transformed into less reactive compounds.

The shortcomings of this method are: CO_2 and NO_x emissions to the atmospheric air, formation of secondary waste: ash contaminated with heavy metals (in a conservative form). However, the resulting ash could be used for the production of construction materials, fertilizers or various soils.

Sludge composting has many disadvantages. This method requires big quantities of peat and sand, is land- and time-consuming. The resulting compost has a strong odor, *is contaminated with heavy metals, infected with various pathogenic organisms and has a limited application.*

2. SOUTH-WEST WASTEWATER TREATMENT PLANT

The South-West Wastewater Treatment Plant (SWTP) of SUE "Vodokanal of St. Petersburg" is located in the South-West non-residential zone within Krasnoselsky Administrative District in St. Petersburg where construction is limited because of the proximity to Pulkovo Airport runways.

Now the South-West non-residential zone is occupied by the following facilities:

- east of SWTP – sludge beds, sludge landfill of the Central Wastewater Treatment Plant (Central WWTP), a group of freight car operating companies and navigation facilities of Pulkovo Airport;
- south of SWTP – a waste-processing plant and a district heating boiler plant;
- west of SWTP – communal parking lots for private cars;
- north of SWTP – temporary communal vegetable gardens.

The total SWTP area, considering future extension, is approximately 7,200,000 m^2 (72 hectares).

The nearest residential areas are located:

- 600 m north-west of the SWTP border (1200 m from the main source of emissions) – individual housing in Krasnaya st., Volodarsky community;
- 900 m north-east of the SWTP border (1250 m from the main source of emissions) – apartment blocks of the residential micro-district “Sosnovaya Polyana”;
- 1500 m east of the SWTP border (2000 m from the main source of emissions) – individual housing of Staropanovo community;
- 800 m south of the SWTP border (1000 m from the main source of emissions) – gardeners’ partnerships on the Leningrad Region lands;
- 550 m west of the SWTP border (1100 m from the main source of emissions) – gardeners’ partnerships adjacent to Volodarsky community, south of Volkhonskoye shosse.

The South-West Wastewater Treatment Plant treats the wastewater collected from the south-western districts of St. Petersburg, the Plant capacity is 330,000 m^3 of wastewater per day.

The SWTP comprises the following process units (productions):

- main pumping compressor station;
- mechanical treatment;
- biological treatment;
- dry sludge incineration plant (addressed in the feasibility study, now at the design stage).

In addition to the main production the SWTP has auxiliary units:

- chemical-biological laboratory;
- mechanical workshop;
- roofless parking for motor transport;
- natural-gas-fired boiler plant.

The wastewater treatment process at SWTP is similar to those used at other municipal WWTPs in St. Petersburg. The wastewater treatment process has the following stages: mechanical treatment (screens, grit channels and skimming tanks), pre-clarification, biological removal of organic substances, nutrient (nitrogen and phosphorus) removal, production of clean wastewater and sludge dewatering. Bio-treated wastewater flows to a storage tank and then is discharged to the Neva Bay – first through a land-based effluent sewer and then through an underwater sewer.

2.1 Disposal of dry sludge after WWTP – Current situation and required changes

The main (in terms of tonnage) type of waste at the SWTP St. Petersburg is a mix of sewage sludge produced by mechanical and biological treatment of wastewater, and excess activated sludge. The water content in the wet mix reaches 98%, however, after the dewatering by centrifuges or centripresses the resulting cake has the humidity of 72-82%.

Now the cake is disposed from the SWTP area to a special landfill (sludge beds) where it is placed in the recesses made in the soil. Both sewage sludge, and excess activated sludge constitute little threat (hazard class 4), however they emit gaseous substances to the atmospheric air, mainly, foul-smelling organic derivatives of hydrogen sulphide and phosphine.

In the climatic conditions of St. Petersburg with its high humidity, the lack of solar radiation and more atmospheric precipitation than evaporation of moist from the ground surface, the highly humid sludge after WWTPs will never dry out completely, and therefore it will stay on the sludge beds for an indefinitely long time accumulating and occupying still more areas.

This situation urged to seek new solutions for the cake treatment process. One radical solution is incineration of produced cake in special stationary fluidized-sand-bed furnaces.

This technology is not a new one and is already used at the Central WWTP (Bely Island) in St. Petersburg. A similar technology will be the basis of the SWTP SIP construction project.

3. SLUDGE INCINERATION PLANT

The main fuel for the sludge incineration plant (SIP) is the WWTP sludge dewatered on decanting centrifuges. A certain quantity of grease produced at the WWTP will also be burnt.

Natural gas will be used as a back-up fuel, however, to a limited extent.

Incineration process

The sludge incineration process has several stages: dewatering, burning, heat recovery for energy production and space heating, and flue gas cleaning.

Two similar incineration lines will be installed at the plant, the maximum daily capacity of each being 44 tons DS / day plus 2.2 tons of grease / day.

The dewatered sludge (together with grease) from wastewater treatment facilities will be fed to fluidized-bed incinerators.

The fluidized-bed incinerator consists of a cylindrical combustion chamber with fire-resistant lining under which a start-up burner is installed. Sludge will be burnt at a temperature above 850°C. The air injected into the furnace maintains fluidized condition of the sand in the lower

zone and ensures optimal heat- and mass-exchange between the sludge and air. The heat generated by the combustion process is used to produce process steam in two waste-heat boilers.

Pre-heated process steam from both waste-heat boilers is delivered to a common turbine and converted to electric energy.

The design of fluidized-bed incinerators has no means to remove ash from the system. As a result, all produced ash flies as dust to the flue gas cleaning system. The flue gas exits the waste-heat boiler at a temperature below 210 °C and enters a multi-stage cleaning system which has the following stages:

- Three-cell electrostatic precipitator removes ash from the flue gas. After separation, dry or wet ash can be loaded on trucks to take it away for utilization;
- The flue gas is cooled in a heat exchanger (thermal gas / thermal gas) and then delivered to a scrubber system. Cold, cleaned fuel gas after the scrubbers passes through the heat exchanger once again and is heated up to 120°C at least.

Although the method to be implemented at the SWTP is in many respects similar to the technology already used at the Central WWTP and designed for use at the Northern WWTP's reconstructed sludge incinerator, it has some significant distinctive features which help protect the environment from negative impacts and are appreciated as positive. E.g., dispersed lime is added to the sludge before incineration to enable effective binding of sour gases and, especially, phosphor oxides which are present in bigger quantities compared to other similar plants due to a special wastewater treatment technology at the SWTP. Another positive distinction is effective chemosorption with TMT solution at the second stage of wet cleaning of flue gases which helps remove from the emissions and concentrate a large quantity of heavy metals including very harmful volatile compounds of cadmium and mercury. Dioxines and furanes are removed without using any special agents.

4. ENVIRONMENTAL SITUATION IN THE AREA AROUND THE SIP CONSTRUCTION PROJECT

In terms of aeroclimatic conditions, the SWTP area can be characterized as an Atlantic-continental climatic region of the temperate zone. The atmospheric circulation conditions play the leading role in the interaction of all climate-forming factors.

Relatively high repeatability of westerlies of the air masses from the Atlantic feature this area and determine the marine characteristics of its climate, such as mild winter, cool summer and big atmospheric precipitation.

The territory adjacent to the SWTP is located on the south-western coast of the Gulf of Finland within the Prinevskaya plain which has a low altitude in this area. The surface of this plain is a series of coastal flatlands with intermittent small hilly patches. The area is a planned site with natural elevations 16.95 – 17.54 m Baltic System.

The effluent pipeline (sewer) crosses the first and second coastal terraces and ends in the Neva Bay at the Morskoy Canal dam headwall. Wastewater is delivered to the treatment plant (main pumping station) via a tunnel sewer. The depth of the pumping station's underground part is 42.25 m (the bottom elevation is 25.2 m BS).

The geological structure of the land plot (down to 20.0 m) includes technogenic, Upper-Quarternary glacier deposits, Cambrian deposits.

An aquifer at the depth of 7.50-8.2 m (which corresponds to TVDSS 8.20 – 7.50 m) features the groundwater conditions of the site.

The ground water is associated with sand interbeds in the glacial loams and has a local head up to 4.0 meters. The established level is 4.40 – 3.60 m.

Vadose water may appear in the periods of heavy precipitation and snow-melting.

The groundwater is fed by infiltration of atmospheric precipitation. The aquifer is discharged to the Dudergofka River valley.

The hydrographic network around the SWTP SIP project is not well-developed, the boggy parts of the water catchment area are drained by reclamation ditches.

The natural vegetation cover within the SWTP and its buffer zone is strongly affected by man. Just some islets of the former floristic systems are preserved. The tree vegetation is represented by thickets of parvifoliate species, such as birch, grey alder, aspen and diverse willows of vegetative origin. Patches of pine trees can be found among the thickets of foliaceous species in some places. Bluejoints and reeds growing along the waterside of ponds and reclamation ditches dominate in the herbaceous cover.

Habitations of two species of amphibia, 1 specie of reptiles, 108 species of birds (15 orders) and 19 species of mammals (6 orders) have been found in the investigated area and in the vicinity of the SWTP. Twenty species of birds and 3 species of mammals are put on the Red Book of Nature of the Leningrad Region. Two species of birds are put on the European Union's Red Book.

The Neva Bay, like the whole eastern part of the Gulf of Finland, is classified as the highest-category fishery water body. The water quality in the Neva Bay must comply with the fishery standards. The ichthyofauna of the Neva Bay is represented by 37 fish species of 16 families and lamprey. The characteristic combination of fish species is represented by freshwater fishes, such as ruff, pike-perch, perch, roach, blay, bream and thornback. Representatives of the sea fauna seldom come into the Bay – only with the inflow of sea waters. The ichthyocenosis of the Neva Bay is characterized by variability of species, number and age of populations. This can be explained by the functional role of the Bay as a spawning ground of widely-spread fish species and a pasture area of young fish.

5. SOCIAL AND ECONOMIC SITUATION IN THE SIP PROJECT AREA

The land occupied by the SWTP including the land allocated for the SIP construction site is part of Krasnoselsky District of St. Petersburg.

Before the start of construction this area was a wasteland intersected by drainage ditches and partly covered with bushes, i.e. these fields with an old meliorative network were not used for agricultural production. They had little value for agriculture as they were not suitable for crop growing.

The site within the SWTP area allocated for the SIP construction project is within a sufficient distance from the communities which have been used traditionally for recreational purposes.

Generally, the SWTP area is located in a triangle between three communities of Municipal Unit "Krasnoselsky District": Ligovo, Staro-Panovo and Volodarsky. On two sides the area is limited by the rail tracks of Baltiyskaya Railway leading in the direction of Oranienbaum and Gatchina.

The impact zone comprises some communities and natural objects of St. Petersburg and the Leningrad Region.

The highest technogenic load on the area adjacent to the project in question is on the Tallinskoye motorway side where many industrial enterprises of Krasnoselsky District are located.

6. HEALTH AND ENVIRONMENTAL ASPECTS OF THE PROJECT AREA

The assessment of children health in the SWTP area shows a lower incidence rate of hemopathy and anaemia, endocrine and ocular diseases, myopia, allergic rhinitis and chronic pharyngitis among the children than the general incidence rate for St. Petersburg. The other indicators turned out to be higher than in St. Petersburg. The incidence rate among the Krasnoselsky District teenagers is lower than in the city for ocular diseases, myopia, chronic pharyngitis, atopic dermatitis and injuries. Similar incidence rates among the children and teenagers are also observed in Vasileostrovsky District.

It was not possible to identify any regularities of incidence rates in the clinics of Krasnoselsky District. Moreover, the lowest incidence rates are observed in the residential areas neighboring the SWTP (clinics 50 and 91). It is only in the area served by clinic 106 that the inhabitants' complaints of diseases caused by the changes of environment have been registered.

The incidence rate among the infants in Krasnoselsky District is very high, and yet it is lower than in St. Petersburg. Respiratory diseases are the most frequent among the infants.

The highest incidence rate of respiratory diseases among the children is observed in the northern part of Krasnoye Selo and in Mozhaisky community. The latter also has a higher incidence rate of bronchial asthma.

Skin and hypoderm diseases characteristic for newly-built districts are observed more often only in one part of Krasnoye Selo. The congenital anomalies observed in the quarters north of the SWTP, as well as in Volodarsky, should be noted. The multiyear observations show that malignant tumors are also widely spread in these quarters which may be explained by the pollution caused by the air transport (airplanes).

Consequently, Krasnoselsky District of St. Petersburg is characterized by a higher incidence rate among the children which may be caused by special features of human environment: private houses, big distances to educational institutions, low subsistence level and other factors. There is little difference between the children's incidence rate in this district and that in Vasileostrovsky District. The analysis of spatial distribution of the diseases identified by periodic health examinations emphasizes the residential areas located near to the airfield.

7. CURRENT ENVIRONMENTAL SITUATION

The atmospheric air in the district is polluted with emissions from industrial enterprises of Kirovsky and Krasnoselsky Districts and from the neighboring motorways (Petergofskoye and Tallinskoye motorways, Marshala Zhukova ave. and Narodnogo Opolcheniya ave.).

The highest background pollution level is that of nitrogen dioxide: 0.85 – 1,10 MAC; carbon dioxide is 0.13-0.16 MAC. The major contribution to the air pollution with nitrogen dioxide is made by motor transport in Petergofskoye, Volkhonskoye and Tallinskoye motorways, Marshala Zhukova ave. and Narodnogo Opolcheniya ave. (61%), by Southern CHP-14 (15%), AO "Kirovsky Zavod" productions (8%), boiler plants of the GUP "TEK SPb" Krasnoselsky Branch (5%) and others.

Cadmium concentrations are higher compared to other areas. This is caused by the electroplating process used by an enterprise next to the SWTP. Pollution with lead and copper turned out to be insignificant.

8. IMPACT ON THE NATURAL AND SOCIAL ENVIRONMENT

The sludge incineration plant construction project will impact the natural and social environment.

The project may have the following consequences:

1) emission of harmful substances to the atmosphere in the course of the plant operation and in emergency situations (breakdowns);
2) formation of process waste;
3) water consumption and wastewater disposal;
4) noise pollution;
5) demand for land resources.

Impact on the atmospheric air

When the sludge incineration plant is put into operation all its sources will emit to the air 33.77 tons/year of pollutants. The pollutants will contain 17 solid substances (1.17 t/year) and 7 liquid / gaseous substances (see Table 1).

Specific emission of pollutants to the atmosphere is the most important indicator of environmental performance for any production. After the commissioning of the sludge incineration plant the total specific emission of all pollutants to the atmosphere are expected at the level of 0.001097 tons per 1 ton DS.

The calculations of maximum concentrations have shown that the impact of the emission sources on the pollution (with all investigated substances and groups of substances causing a summation effect) of the bottom layer of atmospheric air beyond the buffer zone is insignificant: the maximum concentrations are under 0.1 MAC. The maximum concentrations of nitrogen dioxide are in the range of 0.04-0.10 MAC.

List of Pollutants Discharged into Atmosphere by the Designed SIP

Table 1

Substance		*Applied criterion*	*Criterion value, mg/m3*	*Hazard class*	*Aggregate emission*	
code	*name*				*g/day*	*t/a*
1	**2**	**3**	**4**	**5**	**6**	**7**
110	Vanadium pentoxide	MAC с/с	0.0020000	1	0.0000142	0.000408
123	Ferrous oxide	MAC с/с	0.0400000	3	0.0000018	0.000052
133	Cadmium oxide	MAC с/с	0.0003000	1	0.0001626	0.004682
134	Cobalt (cobalt metal)	MAC с/с	0.0004000	2	0.0000048	0.000138
138	Magnesium oxide	MAC м/р	0.4000000	3	0.0001950	0.005616
146	Copper II oxide	MAC с/с	0.0020000	2	0.0002800	0.008062
155	Sodium carbonate	MAC м/р	0.1500000	3	0.0000070	0.000270
163	Nickel (nickel metal)	MAC с/с	0.0010000	2	0.0002844	0.008190
183	Mercy (mercy metal)	MAC с/с	0.0003000	1	0.0002800	0.008000
184	Lead and its compounds	MAC м/р	0.0010000	1	0.0005690	0.016388
191	Thallous carbonate	MAC с/с	0.0004000	1	0.0000706	0.002034
203	Chrome VI oxide	MAC с/с	0.0015000	1	0.0004876	0.014042
207	Zinc oxide (in zinc equivalent)	MAC с/с	0.0500000	3	0.0009800	0.028224
290	Antimony	SRLI	0.0100000	-	0.0000078	0.061760
301	Nitrogen dioxide (nitrogen IV oxide)	MAC м/р	0.0850000	2	0.6720000	19.353600
304	Nitrogen II oxide (nitrogen oxide)	MAC м/р	0.4000000	3	0.1092000	3.144960
316	Hydrochloric acid	MAC м/р	0.2000000	2	0.0001400	0.403000
325	Arsenic and its compounds	MAC с/с	0.0003000	1	0.0000308	0.000888
330	Sulphurous oxide	MAC м/р	0.5000000	3	0.2100000	6.048000
337	Carbon oxide	MAC м/р	5.0000000	4	0.1050000	3.024000
342	Gaseous flourides	MAC м/р	0.0200000	2	0.0010500	0.030000
703	Benzpyrene (3,4-benxpyrene)	MAC с/с	0.0000010	1	0.0000036	0.000138
2902	Suspended solids	MAC м/р	0.5000000	3	0.0006190	1.614730
3620	Dioxins and furans	MAC с/с	$10 \cdot 0.5^{-9}$	1	$10 \cdot 0.14^{-9}$	$10 \cdot 4.0^{-9}$

Substance		*Applied criterion*	*Criterion value, mg/m3*	*Hazard class*	*Aggregate emission*	
code	*name*				*g/day*	*t/a*
1	**2**	**3**	**4**	**5**	**6**	**7**
Total substances : 24					1.1013882	33.777182
including solid substances : 17					0.0039982	1.773622
liquid/gaseous substances : 7					1.0973900	32.003560
Groups of substances with summation effect:						
6009	(2) 301 330					
6018	(2) 110 330					
6019	(2) 110 203					
6030	(2) 325 184					
6034	(2) 184 330					
6039	(2) 330 342					
6042	(2) 330 163					

Concentrations of pollutants from incinerator's gas emission will be lower than EU norms.

The sanitary-protection zone of the South-West Wastewater Treatment Plant is determined as 1 000 m (starting from the upper heated source of the sludge incineration plant).

At the boundary of the sanitary-protection zone and residential area concentrations do not exceed 0.1 MAC.

The impact produced by the designed sludge incineration plant on the atmospheric air **will not result in deterioration of the atmospheric air and excess of the criteria set for the quality of the atmospheric air in neighboring housing areas.**

Process plants and equipment to be located at the SWTP site and the sludge incineration plant are not considered as potential hazardous facilities, which may become a place for emergency situations causing material environmental impact on the atmospheric air produced by emissions. Nevertheless, some emergency situations were simulated. For instance, if at the first-stage of flue gas treatment, where fly ash is removed from the outlet of the waste-heat boiler by an electrostatic precipitator, there is a temporary break of one of the electrical fields resulting in a higher concentration of dust (~ 200 mg/Nm^3), then according to the performed impact

assessment the emissions of suspended solids will not influence the quality of the atmospheric air, since the value of maximum ground level concentration accounts for less than 0.10 MAC.

In case of other simulated emergency situation, when there is a lack of heat energy produced by SIP for SWTP, and the boiler house operates on diesel fuel, the value of maximum ground level concentration of nitrogen dioxide will not exceed 0.13 MAC at the boundary of the sanitary-protection zone and 0.09 MAC at the residential area.

Waste

Earthworks, construction and installation works are planned to be done in the course of the construction of a new building and sludge incineration plant, which leads to formation of construction waste. Total amount of waste to be generated within the whole term of project implementation will account for 3567.99 tons. 13.76 tons out of the total amount are attributed to five types of the 4th hazardous class (low hazardous), the remaining 3554.23 tons – to eleven types of the 5th hazardous class (non-hazardous).

Total amount of waste to be generated during the operation of the sludge incineration will account for 9062.54 tons per annum.

Ash produced by sludge incineration forms the most considerable portion of total waste and accounts for 8481.3 tons per annum or 93.6% of total waste.

Sludge incineration ash is a homogeneous, bacteria-free, fine, sorrel powder without any odour. Ash has low-activity in terms of chemical reactions. It does not react with gases in atmosphere and water in precipitation. Ash has a low water-solubility. Additional experiments have shown a low level of heavy metal leaching from the produced ash, which witnesses to the fact that major portion of heavy metals is contained in low-soluble compounds. Ash is attributed to the 4th hazard class (low hazardous).

After commissioning the sludge incineration plant and undertaking some studies the produced ash may be used for production of different materials. In this case it will not be disposed to landfills any more.

Waste of the 1st hazard class (mercury-vapour lamps – 0.07 t/a, and mercury containing waste (used TNT-15) – 2.7 t/a) is to be utilized in accordance with the established order.

Water Supply and Wastewater Disposal

Water Supply Specific character of the designed sludge incineration plant determines the fact that the sludge incinerator does not actually influence the SWTP water supply, since for process purposes the sludge incineration plant uses its own water from the effluent system.

The sludge incineration plant uses the following types of water: process water, cooling water and drinking water.

Process and cooling water (used for cooling) is of the same quality and is taken from the effluent system of the wastewater treatment plant (WTP).

Cooling water is used solely for a stream condenser.

Drinking water is used for boiler make-up water plant, emergency water silo and emergency showers.

During the operation of SIP the consumption rate for process and drinking water accounts for 20 – 60 m^3/d subject to the load on furnaces.

Such water consumption rate of the designed sludge incineration plant will not produce any impact on the condition of surface water and surface water sources, since water will be supplied from other sources, which are not connected with local water courses and water bodies.

Wastewater Disposal Currently the wastewater treatment plant receives 330 000 m^3 per day of industrial and household wastewater. The designed sludge incineration plant will not change considerably the composition and volume of wastewater to be treated at SWTP, since the amount of water used for process purposes at the sludge incineration plant accounts for less than 1% of total wastewater treated at WTP.

Water used for wet treatment of flue gases (both lines of scrubber treatment) undergoes treatment at the Bleed Water Treatment Plant (BWTP), which neutralizes water, removes heavy metals and suspended solids.

Noise

Process equipment and suction-and exhaust ventilation are the sources of noise at the SWTP.

Acoustical effect has been assessed taking into consideration all sources of noise, which exist during the operation of the SWTP, namely, process equipment of the wastewater treatment plant, ventilation system of the buildings and vehicles. According to the assessment results the noise level in reference points located at the boundary of the sanitary-protection zone, at the residential area and in residential buildings will comply with sanitary norms.

mpact on Land Resources

All works related to the construction of the sludge incineration plant will be carried out within the boundaries of the SWTP site. Dimension of the SIP site is 40 m × 40 m.

Additional land resources for the project implementation are not required.

Land-use pattern will not be changed after the completion of the construction. The territory will not be polluted, since after the completion of the construction landscaping and planting of greenery will be done at the area adjacent to the incineration plant. Storm water collected from the unbuilt area during construction will be transported through storm water wells into the existing storm water sewer of the SWTP and then pumped to the inlet of the wastewater treatment plant.

Impact on Soil

Soil contamination (construction waste, contamination caused by vehicles) is possible at the site of the sludge incineration plant during construction works. Upon the completion of the construction waste will be taken away. Landscaping works and planting of greenery will be done at the adjacent area. Soil excavated in the course of the construction will be used for backfilling works at the boundaries of the South-West Wastewater Treatment Plant.

During the plant operation in hazy weather the exhaust gases from the stack of the sludge incineration plant will fall into soil together with precipitations due to the interaction of nitrogen dioxide with moisture. However, washing character of the earth cover and its hyperhydration at the boundaries of the sanitary-protection zone will ensure resistance of soil to this kind of impact.

No additional measures are required to protect the earth cover at the impact area of the sludge incineration plant.

Impact on Surface Water Bodies and Surface Water Sources

Water consumption of the designed sludge incineration plant will not affect the condition of the surface water and its source, since water will be supplied from other sources, which are not connected with local water courses and water bodies.

Wastewater disposed from the sludge incineration plant will not change parameters of the surface water flow from the territory within the impact area of the plant.

In spite of the fact that at present the environmental load on the Neva Bay is very high, effluent coming from the new sludge incineration plant will not produce any significant impact on the composition and volume of effluent discharged from the South-West Wastewater Treatment Plant.

Impact on Underground Water Sources

The designed sludge incineration plant does not need any underground water sources. Waterproofing of underground vessels is envisaged to prevent potential contamination of the underground water. Construction and operation of the sludge incineration plant does not aggravate the existing impact produced by the SWTP on the underground water.

Impact on Vegetation

Vegetation of the sanitary-protection zone is rather poor and consists mainly of young birches, aspens, grey alders and different kinds of willows.

It might be expected that air pollution (caused mainly by discharge of nitrogen dioxides) will not produce any material impact on tree and grass vegetation. It will not affect also common pines growing under foliage trees.

Changes in species composition, condition, producing capacity and infestation of vegetation are not foreseen.

Impact on Fauna

According to primary forecast there will be no material changes in species composition, numbers, gene pool, producing capacity of animal community within the impact area of the sludge incineration plant. The territory, where the South-West Wastewater Treatment Plant is located, encompasses migration routs for birds, and above all, for dendrophilous birds. In area adjacent to the SWTP birds, in particular small perching birds, build their nests. Even this kind of vertebrate species will not be damaged by the construction of the sludge incineration plant.

Waste produced by incineration (smoke (steam)) will not virtually hinder bird migration.

Intensity and type of impact produced by the designed sludge incineration plant on water biota, including fish fauna, are determined by changes in hydrological and hydrochemical regime of the habitat caused by construction and operation of the sludge incineration plant.

Impact produced by the designed sludge incineration plant on surface waters may be

determined according to three main aspects: water consumption, wastewater disposal and the character of water body itself (the Neva Bay).

I. Water supply is arranged for the designed sludge incineration plant only from existing water sources, which have been already in use and comply with all fishery protection rules. Therefore it may be considered that this aspect does not influence the situation and make any changes into the habitat of biota, in particular fish fauna.

II. According to hydrologists' view wastewater to be disposed from the designed sludge incineration plant will not affect the composition and volume of wastewater, which is presently disposed from the SWTP.

III. Influence produced by the designed sludge incineration plant on ecosystem of the Neva Bay is determined by actual impact of the discharged effluent. Since, as it has been already stated, effluent coming from the sludge incineration plant will account for 1.0% (its portion will be reduced further) of total effluent discharge, its impact will be subtle.

There are no breeding grounds of valuable food fish in the place, where the effluent outlet is located.

Impact on Socioeconomic Situation

In today's context any company irrespective of its field of activities produces certain impact on the environment and causes social strain at the adjacent area. Such impact is different for each specific case. Above all the impact is subject to the applied technologies, qualification and working discipline of the personnel, emergency rate and other factors.

The sanitary-protection zone located around the design sludge incineration plant is adequate and meets the ecological requirements.

Neighboring population centers: Volodarsky, Gorelovo, Strelna are located at a considerable distance and will feel the effects during some periods, when the wind recurves its direction. The effects will be mainly produced by a specific odour.

Territories beyond Sosnovaya Polyana, Ligovo railway stations, Staro-Panovo and Novo-Panovo population centers are located on leeward and will not be affected by the sludge incineration plant.

Impact on Population's Health

Additional contamination may be caused in this area due to the emission of nitrogen oxides and sulfur dioxide. Substances with summation effect will reach 0.1 MAC only for combination of nitrogen oxides and sulfur oxides.

Contamination of surface waters and soil is not a key factor, which influences the population's health.

When we forecast health of the population in the neighboring settlements, it should be noted that there are no grounds for an adverse impact on health. The forecasted contamination level is within the maximum permissible concentration and does not require risk assessment. Since the concentration of chemical substances (maximum ground level concentrations) at the boundaries of the sanitary-protection zone is less than 0.10% MAC, the sludge incineration plant, in case of its trouble-free operation, will not produce any impact on populations' health.

In case of the simulated emergancy situations the maximum ground level concentrations will account for 0.09 MAC in the residential area.

Accroding to "Criteria for Assesing Ecoligical Situation to Identify Zones of Ecological Disorder", Moscow, 1992 (approved by the Ministry for the Environment and Natural Resources of the Russina Federation on November 30, 1992) Volodarsky population center is not affected by any of the factors specified in this document.

CONCLUSIONS

Incineration of sludge produced in the course of wastewater treatment enables to minimize its mass and volume, prevent greenhouse gas emissions (for instance CH_4), facilitate protection of underground waters and strengthen the operation of municipal sewage system.

The advanced multi-staged flue gas treatment is applied to remove heavy metals and dioxides from flue gases produced by sludge incineration.

Implmenetation of the project for the construction of the sludge incineration plant will enable to:

– solve the problem of sludge reclamation by more environmentally safe method;

– stop the disposal and accumulation of non-disinfected and untreated sludge at Volkhonka-2 landfill;

– stop allocation of land plots in surburbs for arramngemt of landfills to dispose non-disinfected and untreated sludge;

– reduce by several times the number of vehicles used for sludge disposal, transportation costs and car emissions (car emissions will be reduced from 55 t/a up to 8.1 t/a);

– improve the environmental situation in the south-western part of St. Petersburg;

– provide heat energy for internal use of the South-West Wastewater Treatment Plant.